Space Weather Technical Forecast

Issued on Wednesday, 04 October 2023 at 01:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-flares throughout. Slight chance of isolated G1/Minor Storm interval today (4th Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low, with a peak flare of C3.5 at 03/0940 UTC from AR3450. There are currently eight numbered sunspot regions on the visible disc, the largest being AR3452 (Eai/beta).However, smaller AR3450 (Eai/beta) generated the majority of the frequent low level C-class flares, despite showing a slight decay in area. Most of the numbered regions on the disc showed only small changes, although AR3453 showed the greatest development, with a slight growth in its intermediate spots.Two new regions have recently developed, one in the northwest and the other in the southwest, both small, weak and simple regions.

There were no Earth-directed CMEs observed.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were at background levels, generally between340-380 km/s. Density was at or below average. The interplanetary magnetic field (IMF), Bt, was predominantly weak, but increased through the evening to reach moderate levels at 8nT. The north-south component, Bz, was weak throughout, between +2nT and -7nT. Phi angle remained positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electrons were predominantly at Background to Moderate levels, but briefly reached High levels at the peak of the diurnal cycle, peaking at 1297 pfu at 03/1540 UTC. Associated 24-hour fluence was below Active (1e8 integrated pfu) threshold. The observation at 04/0000 UTC was 2.12e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Low activity is expected but with a chance of isolated M-class flares, these most likely from AR3450 but AR3452 is also a candiate. Plus new or returning regions are likely to rotate onto the visible disc through the period.

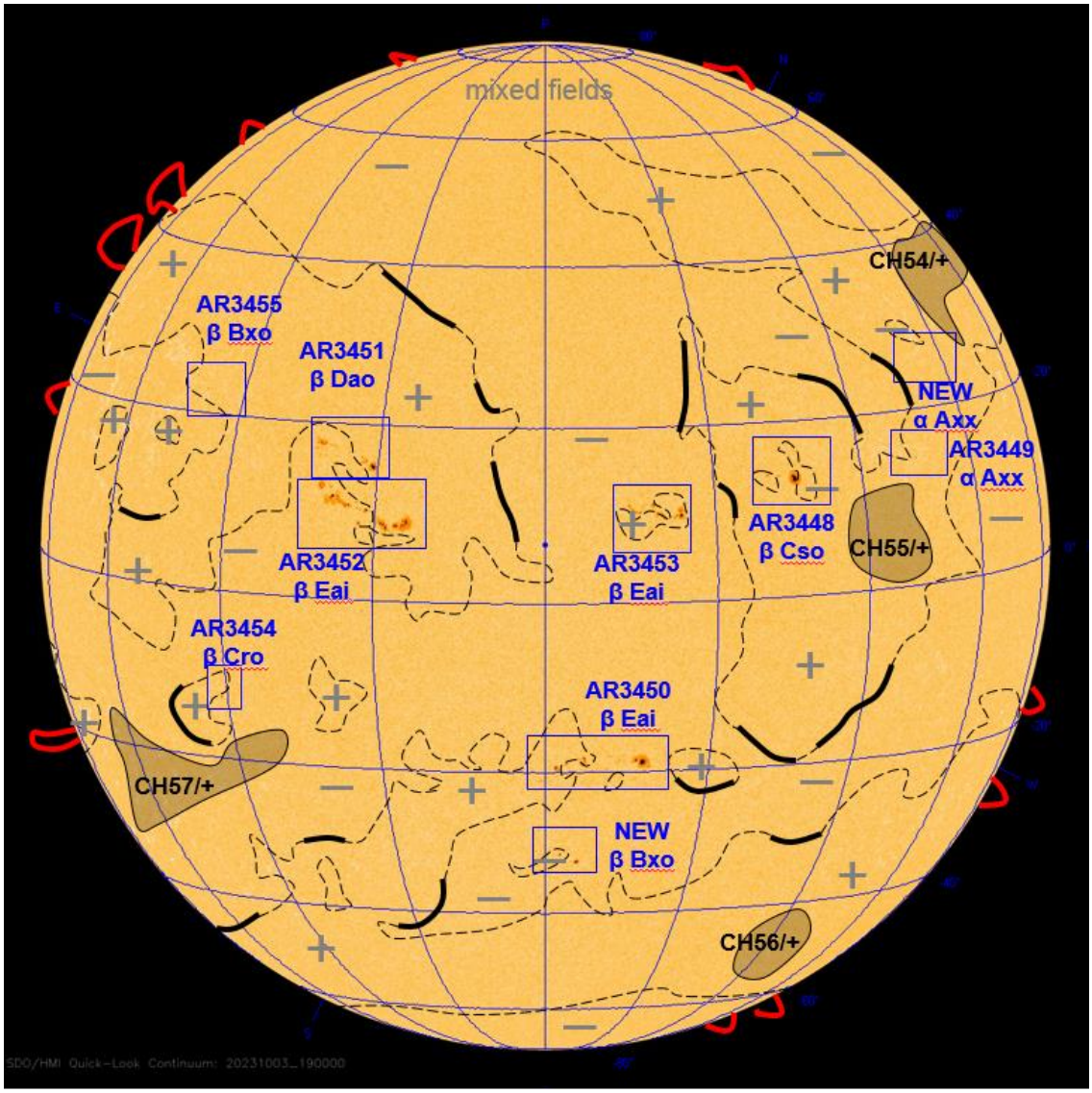
Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs expected. Today (4th Oct), a connection to the fast wind from the small equatorial coronal hole CH55/+ is expected. Any enhancement is likely to be weak, with background wind speeds possibly increasing to slightly elevated levels of 450-500km/s, as indicated in MOSWOC Enlil. Later in the period the solar wind will return to background levels, as any influence from CH55 fades. Mainly Quiet (Kp 0-2) geomagnetic activity is expected with isolated Unsettled (Kp 3) spells. Any fast wind arrival has the potential to bring a spell of Unsettled to Active (Kp 3-4), with a slight chance of G1/Minor Storm (Kp 5) intervals, most likely today (4th Oct).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at Background levels, with no Solar Radiation storms expected. High energy electron flux (greater than 2MeV) observed by GOES16 is expected to vary between Background and Moderate levels, with the potential to reach High levels at the peak of the diuranal cycle from tomorrow onwards, should a HSS arrive from CH55. Fluence is forecast to remain below Active (above 1e8 integrated pfu) levels throughout.

Figure 1. Solar Analysis Valid 03/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

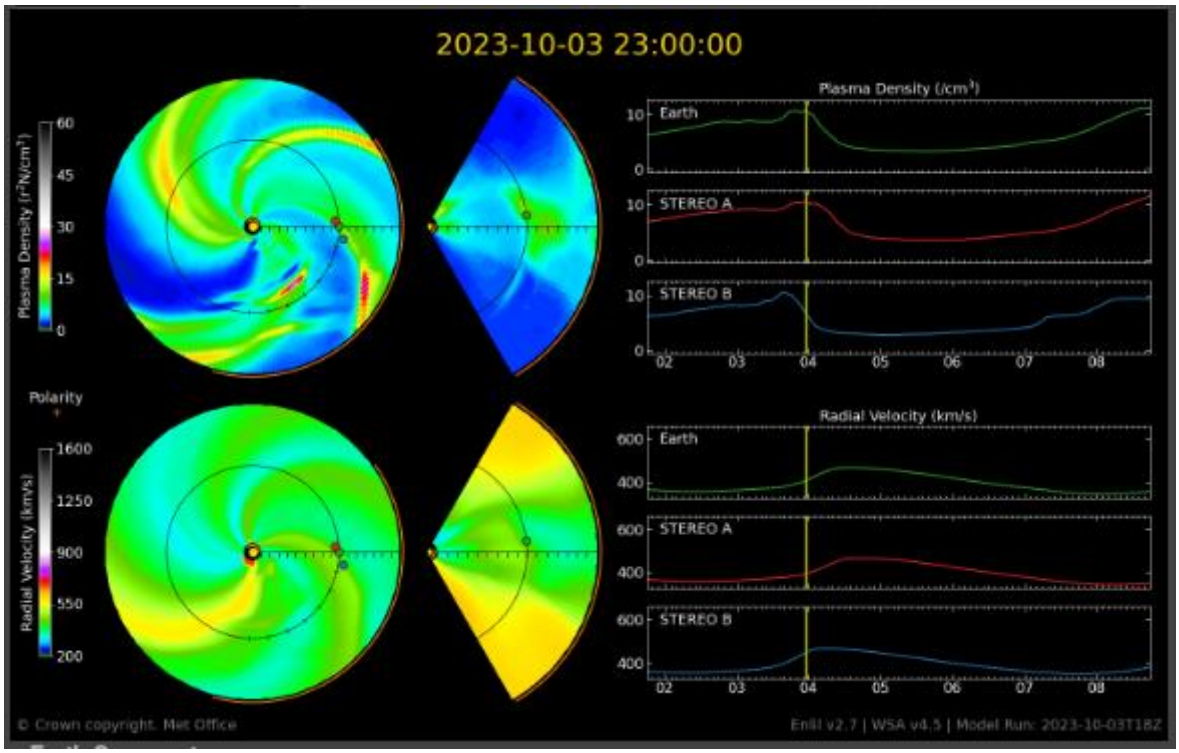
There are currently no Earth-directed CMEs expected.

Today (4th Oct) the arrival of a fast wind associated with equatorial CH55/+ is likely, as indicated in MOSWOC Enlil. This is a small, non-recurrent feature with low confidence for expected speeds, but may increase solar winds to around 450-500km/s, waning later day 2 (5th Oct).
Mainly Quiet (Kp 0-2) geomagnetic activity is expected with isolated Unsettled (Kp 3) spells.
Any fast wind arrival has the potential to bring a spell of Unsettled to Active (Kp 3-4), with a slight chance of G1/Minor Storm (Kp 5) intervals, most likely today (4th Oct).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: MOSWOC Enlil.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently eight numbered sunspot regions on the visible disc, although now AR3455 is now barely visible. Despite AR3450 continuing to decay slightly the region remains the main source for occasional low level C-flares. Most other regions have shown small changes, decreasing or increasing. The greatest development for a numbered region has been confined to AR3453 in the northeast, with a slight increase in the number of intermediate spots. Two new regions have recently developed, one in the northwest and the other in the southwest, both small, weak and simple regions.
Mainly Low activity is forecast to continue, with a chance of isolated M-flares, these most likely from AR3450 but AR3452 is also a potential candidate.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels, with the current sunspots on the disc unlikely to produce proton rich flares.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	2	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

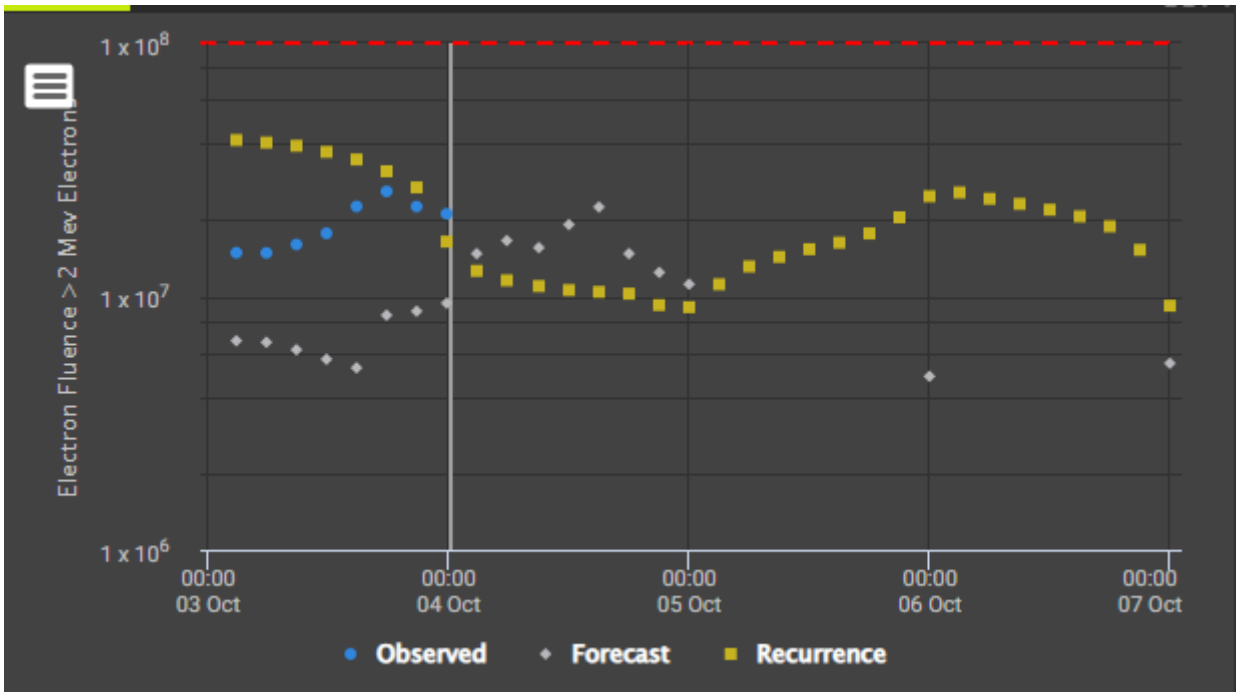
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

High energy electron flux (greater than 2MeV) observed by GOES16, is currently at predominantly background levels. If a HSS from CH55 arrives today then a recovery in flux is then likely from tomorrow (5th Oct), to mainly Moderate levels with a chance of peaking at High during diurnal maximum.
The associated 24 fluence is expected to remain below the Active threshold, with a generally increasing trend. REFM also shows the fluence remaining below Active, but is currently underestimating the fluence and indicates a decreasing trend.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM model.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.